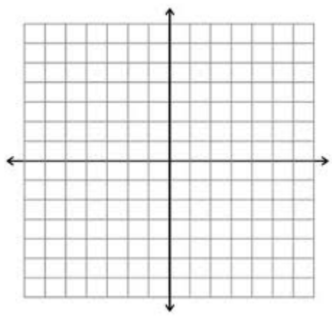
Precalc Warm Up # 1-5

Evaluate without a calculator.

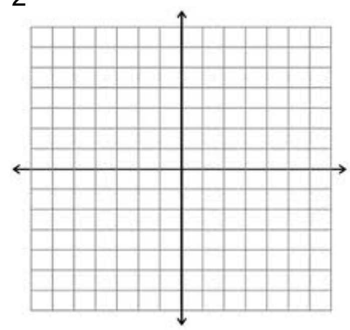
1. $\log_3 27$ 2. $\log_5 \frac{1}{25}$ 3. $\log_{19} 19$ 4. $\log_{23} 1$

Graph.

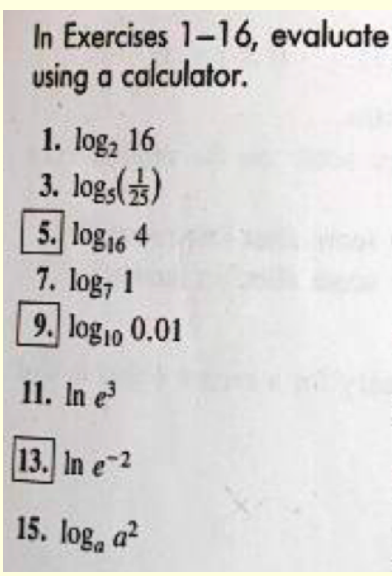
5. $f(x) = \log_2 x$



6. $\log_2(1 - x) + 3$



HW Questions: p. 269



In Exercises 1–16, evaluate using a calculator.

1. $\log_2 16$
3. $\log_5(\frac{1}{25})$
5. $\log_{16} 4$
7. $\log_7 1$
9. $\log_{10} 0.01$
11. $\ln e^3$
13. $\ln e^{-2}$
15. $\log_a a^2$

In Exercises 17–26, use the definition of a logarithm to write the given equation in logarithmic form. For instance, the logarithmic form of $2^3 = 8$ is $\log_2 8 = 3$.

17. $5^3 = 125$

23. $e^3 = 20.0855\ldots$

In Exercises 27–32, use a calculator to evaluate the logarithm. Round your answer to three decimal places.

27. $\log_{10} 345$

31. $\ln(1 + \sqrt{3})$

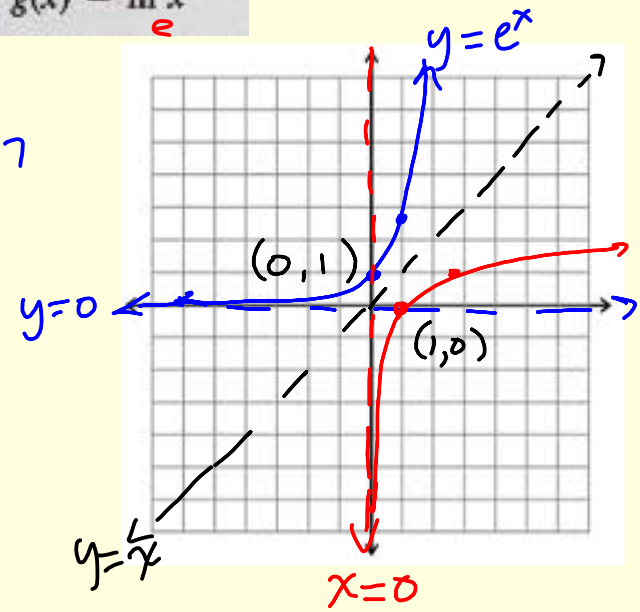
In Exercises 33–36, demonstrate that f and g are inverses of each other by sketching their graphs on the same coordinate plane.

x	1	e
y	0	1

$\boxed{35.}$ $f(x) = e^x$, $g(x) = \ln x$

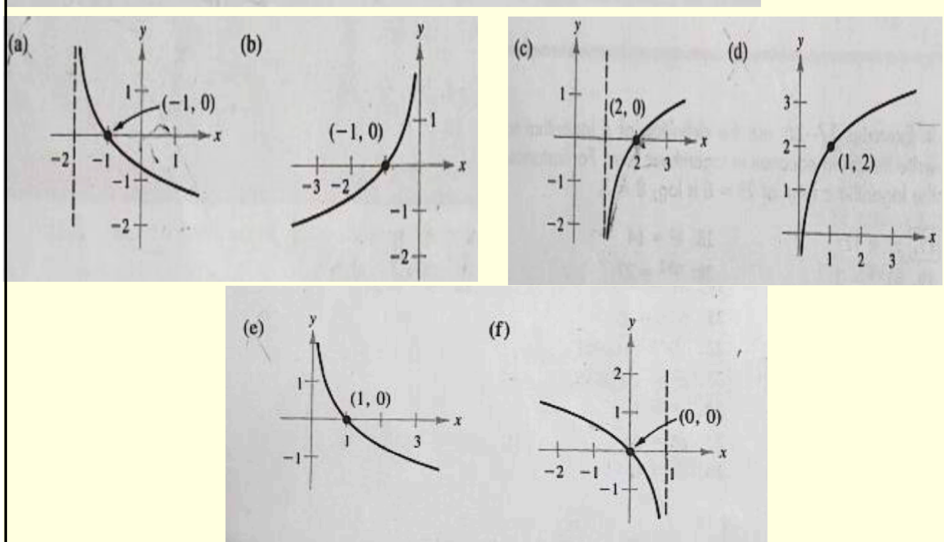
e

x	y
0	1
1	$e \approx 2.7$



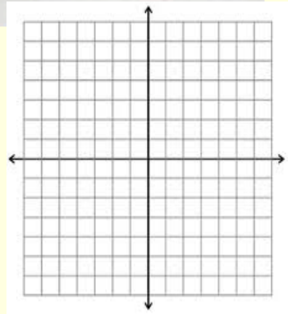
In Exercises 37–42, use the graph of $y = \ln x$ to match the given function to its graph. [The graphs are labeled (a)–(f).]

37. $f(x) = \ln x + 2$
38. $f(x) = -\ln x$
$\boxed{39.}$ $f(x) = -\ln(x + 2)$
40. $f(x) = \ln(x - 1)$
41. $f(x) = \ln(1 - x)$
42. $f(x) = -\ln(-x)$



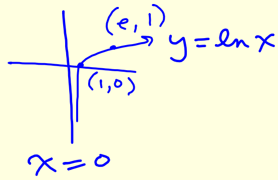
In Exercises 43–50, find the domain, vertical asymptote, and x-intercept of the logarithmic function, and sketch its graph.

45. $h(x) = \log_4(x - 3)$



50. $f(x) = \ln(3 - x)$

$\ln[-(x-3)]$



Rt 3

ry

67. Students in a mathematics class were given an exam and then retested monthly with an equivalent exam. The average score for the class was given by the human memory model

$$f(t) = 80 - 17\log_{10}(t + 1), \qquad 0 \le t \le 12$$

where t is the time in months.

(a) What was the average score on the original exam ($t = 0$)?

(b) What was the average score after four months?

(c) What was the average score after ten months?

69. The population of a town will double in

$$t = \frac{(10 \ln 2)}{(\ln 67 - \ln 50)}$$ $\div$

years. Find t.

$y = \log_a x$ iff $x = a^y$

a must be positive and $\neq 1$, and x must be positive

A logarithm is an exponent.

Basic Log Properties:

$\log_a a = 1$ $\quad \log_a 1 = 0$ $\quad \log_a a^x = x$

Algebraic properties of logarithms

Do logs distribute?

$\log_2 2 + \log_2 8 \stackrel{?}{=} \log_2 (2 + 8)$

$1 + 3 \stackrel{?}{=} \log_2 10$

$4 \neq 3.32$

$\log_2 2 + \log_2 8 = \log_2 (?)$

$4 = \log_2 (16)$

$\log_2 2 + \log_2 8 = \log_2 (2 \cdot 8)$

$\log_3 9 + \log_3 27 \stackrel{?}{=} \log_3 (9 + 27)$

$2 + 3 \stackrel{?}{=} \log_3 36$

$5 \neq 3.26$

$\underbrace{\log_3 9 + \log_3 27}_{5} = \log_3 (?)$

$5 = \log_3 (9 \cdot 27)$

$3^5 = 243$

log rule #1:

Pull

$\log_a uv = \log_a u + \log_a v$

The SUM of two logs is the log of the PRODUCT of the numbers.

Relates to exponent rule:

$a^m a^n = a^{m+n}$

Proof:

let $x = \log_a u$

$a^x = \boxed{u}$

let $y = \log_a v$

$a^y = \boxed{v}$

$\log_a uv = \log_a (a^x \cdot a^y)$

$= \log_a a^{(x+y)}$

$= x + y$

$\log_a uv = \log_a u + \log_a v$

What about subtracting logs?

$\log_2 16 - \log_2 8 \overset{?}{=} \log_2(16 - 8)$

$4 - 3 = \log_2(8)$

$1 \neq 3$

$\underbrace{\log_2 16 - \log_2 8}_{1} = \log_2(?)$

$1 = \log_2 2$

$\log_2\left(\frac{16}{8}\right) = \log_2(2)$

log rule #2:

Relates to exponent rule:

$$\frac{a^m}{a^n} = a^{m-n}$$

Pull

$\log_a(u/v) = \log_a u - \log_a v$

The DIFFERENCE of two logs is the log of the QUOTIENT of the numbers

Proof:

(This proof is on your HW tonight, so we won't do it now!)

Notice that $\log_a x^2 = \log_a(x \cdot x)$

$= \log_a x + \log_a x$

$= 2 \log_a x$

likewise, $\log_a x^3 = \log_a(x \cdot x \cdot x)$

$= \log_a x + \log_a x + \log_a x$

$= 3\log_a x$

log rule #3:

Pull

$\log_a u^b = b \log_a u$

The log of a POWER is the PRODUCT of the power and the log

Proof: Let $x = \log_a u \rightarrow a^x = \boxed{u}$

$\log_a \boxed{u}^b = \log_a (a^x)^b$

$= \log_a a^{bx}$

$= bx$

$= b \log_a u$

Evaluate:

$\log_5 25^7$

$7(\log_5 25)$

$7(\log_5 5^2)$

$7 \cdot 2 = 14$

$\log_5 (5^2)^7$

$\log_5 5^{14}$

$\ln \sqrt[4]{e^3}$

$\ln_e e^{3/4}$

$\frac{3}{4}$

Use the 3 log rules to simplify. (condense)

$2 \ln 8 + 5 \ln x$

$\ln 8^2 + \ln x^5$

$\ln 64 + \ln x^5$

$\ln (64x^5)$

$\frac{3}{2} \log_7 (x - 2)$

all good

$\log_7 (x-2)^{3/2}$

$\log_7 (\sqrt{x-2})^3$

$\log_7 \sqrt{(x-2)^3}$

Use the 3 log rules to write the expression as a sum, difference, or multiple of logarithms. (expand)

1. $\ln 2x^{-5}$

$\ln 2 + \ln x^{-5}$

$\ln 2 - 5 \ln x$

2. $\log_b \frac{\sqrt{x}\, y^4}{2z^5}$

$\log_b \sqrt{x} + \log_b y^4 - \log_b 2 - \log_b z^5$

$\frac{1}{2}\log_b x + 4\log_b y - \log_b 2 - 5\log_b z$

Use the 3 log rules to find the following, given that
$\log_a 2 = 0.4307$ and $\log_a 3 = 0.6826$

1. $\log_a 6$

$\log_a(3 \cdot 2)$

$\log_a(2 \cdot 3)$

$\log_a 2 + \log_a 3$

$0.4307 + 0.6826$

1.1133

2. $\log_a 12$

$\log_a(2^2 \cdot 3)$

$\log_a(3 \cdot 2^2)$

$\log_a 3 + 2\log_a 2$

$0.6826 + 2(0.4307)$

1.544

3. $\log_a 1.5a$

$\log_a\left(\frac{3a}{2}\right)$

$\log_a \frac{3}{2}a$

$\log_a 3a - \log_a 2$

$\log_a 3 + \log_a a - \log_a 2$

$0.6826 + 1 - 0.4307$

1.2519

Next week:

HW Quiz on Tuesday:

PC book pages 259, 269, 276

Quiz Thursday:

PC 4.1 - 4.4 and SL 7.1

Mon: PC Book
T & W: SL Book

Next week:

HW Quiz on Tuesday:

PC book pages 259, 269, 276

Quiz Thursday:

PC 4.1 - 4.4 and SL 7.1

Mon: PC Book
T & W: SL Book

HW: PC book

p. 276 #1 - 39 odd,

and 41 - 71